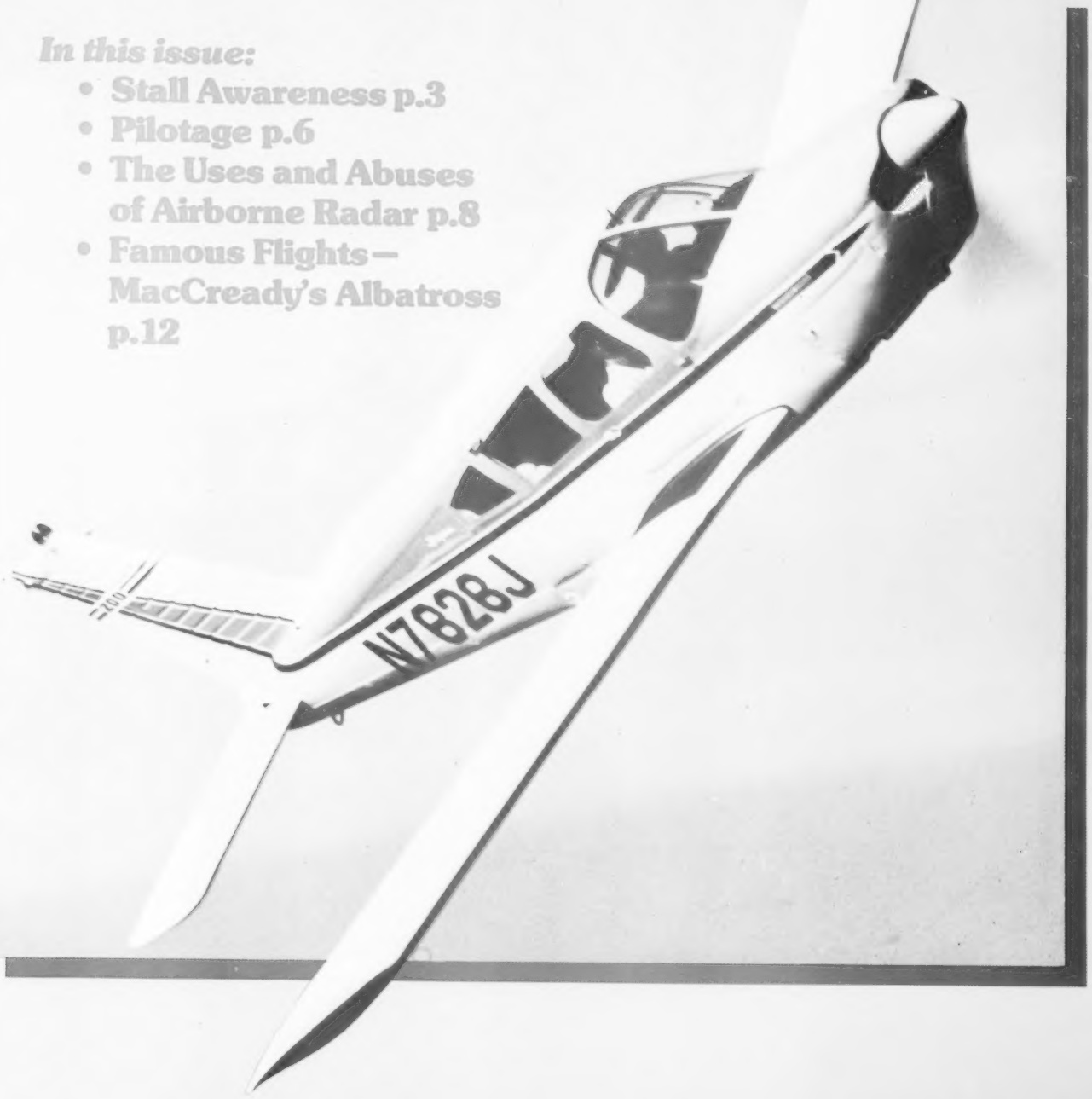
FAA
general aviation NEWS
SEPTEMBER-OCTOBER 1979
A DOT / FAA FLIGHT STANDARDS SAFETY PUBLICATION

In this issue:

- **Stall Awareness p.3**
- **Pilotage p.6**
- **The Uses and Abuses of Airborne Radar p.8**
- **Famous Flights— MacCready's Albatross p.12**



FAA GENERAL AVIATION NEWS

DEPARTMENT OF TRANSPORTATION/ FEDERAL AVIATION ADMINISTRATION

SEPTEMBER-OCTOBER 1979
VOL. 18, NO. 5

Neil Goldschmidt, *Secretary of Transportation*

Langhorne Bond, *Administrator, FAA*

Charles R. Foster, *Assoc. Admin., Aviation Standards*

Kenneth S. Hunt, *Director, Flight Operations*

Bernard A. Geier, *Chief, General Aviation and Commercial Division*

David Gelfan, *Editor*

P.A. Duncan and Louise Oertly, *Assistant editors*

FAA GENERAL AVIATION NEWS is published by Flight Operations, AFO-807, Federal Aviation Administration, Department of Transportation, Washington, D.C. 20591, in the interest of flight safety. The magazine is designed to promote safety in the air by calling the attention of general aviation airmen to current technical, regulatory and procedural matters affecting the safe operation of aircraft. Use of funds for printing FAA GENERAL AVIATION NEWS was approved by the Office of Management and Budget through August 31, 1980. All printed materials contained herein are advisory or informational in nature and should not be construed as having regulatory effect. The FAA does not officially endorse any goods, services, materials or products of manufacturers that may be mentioned. ***Certain details of accidents described herein are altered to protect the privacy of those involved.***

SUBSCRIPTION SERVICES

FAA GENERAL AVIATION NEWS is sold on subscription at $6.20 per year (individual copies, 55 cents) by the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Use the self-mailer order form in the centerfold of this magazine to subscribe. Prices are subject to change without prior notice.

Please anticipate one to two months for processing orders. Subscriptions are for one year only, and only one renewal notice is sent. Act promptly to avoid lapse of subscription.

Subscription problems. Contact the Service Section, SSOS, GPO, Washington, D.C. 20402.

Change of subscribers address. Send both old and new address to MAIL LIST SECTION, GPO, Washington, D.C. 20402.

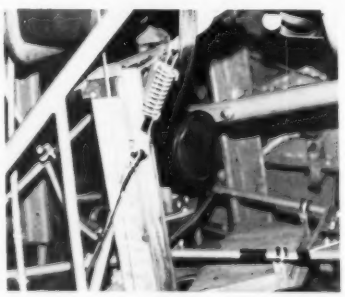
BRIEFS

HOME WEATHER SHOW. A.M. Weather, a daily 15 minute weather report useful to pilots and other travelers, is now appearing on nearly 200 public broadcasting television stations across the nation. The program is supported by funds from FAA and the AOPA Air Safety Foundation. In areas where it has not yet appeared, requests to the nearest public broadcasting TV station may produce the desired result. The program is not a substitute for a complete pre-flight weather briefing, but it is a good preliminary look at what lies in the skies, covering both regional and national data, 12 and 24 hour forecasting, winds aloft, severe storm warnings, and overall conditions.

BACKED OUT STOP BOLT CITED IN FATAL ACCIDENT. After a longer-than-usual takeoff run from North Las Vegas Airport, a chartered PA-31 climbed to about 400 ft., stalled, and crashed. The National Transportation Safety Board determined the probable cause was a backed-out elevator down-stop bolt that limited down elevator travel and made it impossible for the pilot to prevent a pitch-up and stall. Operators and maintenance personnel are advised to check control surface travel especially after any maintenance involving control surfaces and rigging. Pilots should also visually check control surface travel before every flight.

OK IS NOT OK FOR ATC! When aircrews acknowledge with "Okay," it is difficult for Air Traffic Control to know whether the aircrew means "Roger", "Affirmative", "Will comply", "that's correct", or something else, like "No thanks." Though commonly accepted to indicate approval, the word "Okay" is ambiguous and adds potential for confusion. Things could become not-so-okay in a hurry. Make your transmissions crystal clear.

LOOSE OBJECTS IN COCKPIT. Having a good cup of coffee on hand is fine but can be a hazard as an 11,000+ hour ag pilot found out recently. This Mississippi airborne seeder and duster found his control stick jammed on climbout one morning after a stainless steel thermos of coffee became wedged in his controls. After several stalls and recoveries a hundred feet above the ground the pilot managed a no-second-chance grab for the thermos to free his controls and landed safely. Lesson learned?



He still carries the same thermos a year and a half later, but hopefully in a safer place.

Stall Awareness

A cultivated attitude of mind and body

From the earliest days of flying on down to the present day, the unintentional stall has been an everpresent threat to the safety of airmen. As late as the post World War II period, stall/spin accidents were still accounting for nearly one-half of all general aviation fatal accidents. Improved aircraft design and higher training standards have since reduced that ratio to approximately one-fifth of all fatal accidents, but that is still a significant figure, in view of the fact that about 95 percent of stall/spin accidents are attributed to pilot error.

There is a common impression that the typical stall/spin accident occurs to an immature pilot who gets trapped by weather or difficult terrain or is overtaken by nightfall, gets lost, low on fuel, becomes disoriented . . . and in his confusion allows the aircraft to stall and consequently enter a spin from which he is unable to recover. This pattern of events is not unusual, but it is by no means the major source of stall/spin accidents.

An early study by the National Transportation Safety Board identified 1,261 stall/spin accidents in the three year period 1967-69, which accounted for about eight percent of the total accidents in general aviation and nearly one-fourth of the fatalities and serious injuries. The study report disclosed that about 40 percent of stall/spin accidents took place at some distance from an airport, but only eight percent involved lack of pilot ability to cope with weather or ordinary en route conditions: the remaining 33 percent involved distractions, reckless and illegal flying, or some special type of flying, such as cattle roundup, hunting, surveying, or search and rescue, where unusual conditions prevailed. (Federal law prohibits the trapping, killing, or harassing of any fish, bird, or other animal from an aircraft unless under the direction of an appropriate U.S. Government agency.)

Furthermore, the study showed that the great majority of stall/spin accidents—about 60 percent—took place in the landing or takeoff phase of flight, usually in broad daylight and in VFR weather. Some of these landing and takeoff accidents were due to lack of skill or understanding on the part of the pilots; others were preceded by some form of distraction which caused the pilot to neglect his regular panel scanning.

During the decade that followed the Safety Board's original study, FAA placed an increased emphasis on stall awareness, through revision in 1973 of Part 61 of the Federal Aviation Regulations, with the development of the Accident Prevention Program nationwide, and with educational seminars and publications. During a recent review of NTSB accident statistics involving stall/spin accidents covering the years 1974-76, an appreciable decline in accidents of this kind was noted. Stall/spin accidents declined from 1,261 in the 1967-69 period to 981 in 1974-76, a decrease of 22 percent. Fatalities from stall/spin accidents declined from 997 to 887—a reduction of 11 percent. Serious injuries from stall/spin accidents dropped from 464 in the earlier period to 340—a reduction of 26 percent, during a time when serious injuries overall were on the rise in general aviation.

If there is one airman habit pattern which can be relied upon for the avoidance of stall accidents, it is what is known as "stall awareness." No pilot can be regarded as fully proficient who has not developed this habit pattern to a high degree. Stall awareness is not merely a question of memorizing the stalling speeds in various configurations of the airplane, although this knowledge is also essential. Numbers alone are of little help if the mind is preoccupied elsewhere—perhaps with a flight emergency, such as power failure, icing problems, close proximity to another aircraft, etc. Stall awareness is the *unremitting attentiveness to conditions which could bring about loss of control of the aircraft.*

The pilot who is *least* likely to be victimized by an inadvertent stall is one who has developed (in addition to good scanning habits) a sensitive feel for what is happening to the aircraft. In some circumstances the sense of touch or feel or sound may be more informative than the eye. The seat of one's pants is not recommended as a substitute for instruments, but at times it can be a good source of flight information even in the most modern and sophisticated aircraft. Experienced and proficient pilots know exactly the kinds of pressures they should feel in a properly coordinated turn, for example, and they can sense altitude loss more quickly than some instruments.

Pilots who have a clear understanding of stall aerodynamics are less likely to rely on logic or intuition, which can be very misleading. The unseasoned pilot, for example, who in a steep turn near the ground attempts to keep the nose from dropping by pulling back on the yoke, may quickly bring about a stall and possibly a spin, with a much more serious loss of altitude.

What it all comes down to is that stall awareness is something which cannot be learned and retained from books alone: it must be practiced and experienced as regularly as stall recovery. Theory is helpful, and memorizing the numbers is good, but this study should be supplemented with initial and recurrent training in stall prevention in every phase of flight the pilot is likely to encounter.

In 1977 FAA published a report on its "General Aviation Pilot Stall Awareness Training Study," which includes a syllabus for such training. Highlights of the syllabus will be contained in this article and others to follow. (The report, No. FAA RD 77-26, may be purchased for $10.75 with a check or money order payable to the National Technical Information Service, 5285 Port Royal Rd., Springfield, Va. 22161.)

On takeoff, where nearly one-fourth of all stalls occur, there are a variety of conditions which can precipitate a stall. Engine failure on takeoff, for example, is one of these causes. But the stall is not an inevitable consequence of the power failure; most often it results because the pilot does not fly the aircraft properly after the emergency occurs—he may attempt to turn back to the runway, for example, when there is insufficient altitude to complete a safe turn.

In the spring of 1977, an *AeroCommander* took off from Chicago's Miegs Field in mid-afternoon. During takeoff the aircraft encountered a flock of seagulls on the runway, apparently causing loss of power in one engine. According to the National Transportation Safety Board, the pilot elected to return to the airport. With the landing gear and flaps still extended, and while at a low altitude, he entered a steep right turn and subsequently lost control of the aircraft, which crashed into Lake Michigan, killing all four persons on board.

Minimum loss of altitude in an engine-out or power-off turn varies significantly, not only according to make and model, but also according to pilot technique. The only way you can learn

how much altitude you need for such a maneuver in a given aircraft is to perform the maneuver in practice at a safe altitude, using a section of road as a runway indicator.

Clear the airspace, apply carburetor heat as needed, reduce the power to idle, and check the loss in altitude after completing a 180° turn. Do it half a dozen times (after regaining lost altitude) in order to get a good average figure. Also take into consideration an additional altitude loss to account for the difference between an idling prop and one that is windmilling, as well as for the stress component of an actual emergency. Then if you ever do have a power loss you can determine how much maneuvering you can safely accomplish before landing.

If your altitude loss in practice seems pretty far out of line, in comparison with what other pilots do in the same aircraft, then you are probably doing something wrong, and need instruction.

If stall conditions for whatever reason begin to develop after liftoff, the pilot's first concern is to avoid the stall by lowering the nose and establishing an appropriate air speed. However, in certain conditions (jammed elevator, over-weight limits, or out of balance, for example) it may not be possible to get the nose down by normal methods. At a time like this, a thorough understanding of the effect of auxiliary controls, such as flaps or trim, is crucial (see Trim Talk, in the June issue). Additionally when the aircraft is teetering on the verge of a stall, the pilot must recognize that even a slight bank or skid could be enough to initiate the stall. If he has enough airspeed margin over the stall speed to commence a shallow turn back to the runway, he must realize how important it is that the turn be fully coordinated at all times.

For situations of this kind, recurrent training or practice in slow flight can be a lifesaver. During the FAA study of stall awareness in a variety of pilots, it was observed that when most pilots are attempting to keep an airplane perfectly straight and level at minimum airspeeds, to avoid entering into a stall, they may not apply enough right rudder pressure to compensate for the left yawing tendency of the single engine aircraft. All engines built in the United States (for single engine aircraft) rotate clockwise as seen from the pilot's seat. Therefore at high power settings the aircraft will tend to turn to the left, especially when operating at a high angle of attack, unless sufficient right rudder pressure is maintained. If a stall does occur with a left yaw in progress, a spin to the left may quickly follow.

Similarly, a spin may also follow the onset of an inadvertent stall during a right turn, since the additional right rudder pressure necessary for countering the left yaw, as well as coordinating the right turn is often missing.

One undesirable feature of early aileron design, which is still present to some degree in modern ailerons, is the "adverse yaw" which may take place in a turn, when the airplane is in a high angle of attack, as on departure. When the pilot banks into the turn with aileron movement, the aileron on the lowered wing is deflected up—which reduces the camber and the drag at that wingtip. The relative increase in drag on the upgoing wing causes the airplane to yaw in the direction of that wing—or opposite to the direction of the turn. Many pilots experience this phenomenon without understanding what is happening. If they add more downwing aileron (instead of countering the yaw with opposite rudder and keeping the ball centered) the yaw tendency increases. If the airplane stalls in this configuration, a spin may follow.

In most modern airplanes the ailerons are rigged to travel farther upward than down, which reduces somewhat, but does not completely eliminate, the tendency toward adverse yaw. The rudder remains the most effective flight control for lateral/directional control at low airspeeds, especially on single-engine aircraft, where it is directly in the propeller slipstream. The rudder usually operates at low angles of attack, and therefore does not stall.

Flaps are used generally to reduce the stalling speed of an aircraft, but their mis-use can also bring about an inadvertent stall and spin. Imagine a pilot on final approach, with full flaps and at low airspeed. Suppose that for some reason he decides to go around, adding full power and back pressure. In many single engine aircraft the manner in which the flaps are retracted at this point is critical. If they are not retracted, the airplane may be incapable of climbing. If the pilot inadvertently raises the nose to climb attitude with flaps still extended, a departure stall may develop. If they are retracted too soon or too rapidly, the abrupt loss of lift may result in a stall. Since the left-yawing tendency of single engine aircraft is generally greatest in a high power, slow airspeed configuration, a stall under these circumstances could easily be followed by a spin. Go-around with flap retraction should be practiced sufficiently with an instructor on board and at

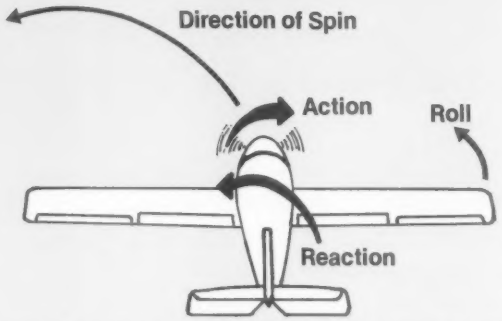
Maneuvering safely after an engine loss at low altitude and slow airspeed requires a highly developed sense of stall awareness.

1976 STALL/SPIN ACCIDENTS

Total accidents: 325

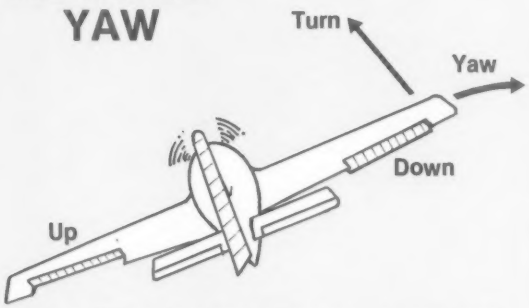
Involvement	Accidents	% of Total Accidents
PILOT		
Private	145	45%
Commercial	125	38%
Student	28	9%
Other	27	8%
TOTAL	325	
WEATHER		
VFR	303	93%
IFR	12	4%
Below VFR Minima	3	3%
TOTAL	325	
TIME		
Daylight	294	90%
Nighttime	22	7%
Unreported	9	3%
TOTAL	325	
KIND OF FLYING		
Personal	214	66%
Commercial	41	13%
Instructional	43	13%
Miscellaneous	27	8%
TOTAL	325	
PHASE OF FLIGHT		
Takeoff	67	21%
Landing	118	36%
Other	140	43%
TOTAL	325	

ROLLING TENDENCY



Because most U.S. aircraft engines turn clockwise (as seen from the cockpit), with a high power setting the aircraft tends to roll to the left unless sufficient right rudder is applied. If an inadvertent stall occurs during the roll, a spin may follow.

ADVERSE YAW



In a turn at high power and with a raised nose, drag increases on the raised wing because of the depressed aileron. This increased drag can cause a yaw in the direction opposite the turn, unless sufficient rudder pressure is maintained. If the airplane should stall at this point, a spin could follow. Adverse yaw is usually more apparent on older aircraft.

altitude before being attempted at an airport. A successful go-around from a position of low altitude and low airspeed, in a real emergency is not as simple a maneuver as some pilots imagine. Useful experience may be obtained from retracting and extending flaps during slow flight at safe altitudes.

Recently a student pilot out of Leesburg, Va., took it upon himself to practice unauthorized engine-out landings away from the airport. On one attempted go-around, the *Cessna-150* flew too low and too slow and crashed, with fatal injuries to the pilot.

It is common knowledge that density altitude, excessive loading and unbalanced loads all contribute to the likelihood of a stall, by degrading the airspeed and lift capability of the aircraft. Improper distribution of weight involves the additional danger, however, in the event a stall does take place, of leading to a flat spin from which some aircraft may not be able to recover. In fact, some four-place aircraft are certified for spins only with both the front seats occupied. This is because when an airplane is loaded so as to move the center of gravity aft of the permissible limit, the effective length at which the horizontal tail is located is decreased. This reduces its stabilizing effect, and results in a flatter spin than may be expected with normal loading, and an increased angle of attack on the horizontal tail. Under these circumstances the elevators may be unable to lower the nose enough to recover from the stall. Check your owner's handbook or flight manual carefully before you allow the rear seats to be occupied with the copilot's seat vacant in a four-place aircraft.

The most common cause of the inadvertent stall is pilot distraction—not only inflight emergencies but any occurrence which absorbs the pilot's attention to the extent that he neglects his primary duty, which is flying the aircraft and monitoring the environment and the panel. The proficient pilot has a thoroughly ingrained habit of scanning and attending to the aircraft, regardless of interruptions. The less disciplined pilot can lose control while simply searching for a pencil that has dropped on the floor or fumbling for a flashlight in the glove compartment. Other frequent distractions include: prolonged radio transmissions, map study, running requests from passengers for information, bickering chil-

STALL FACTORS

An aircraft stalls when its critical angle of attack for a given airspeed and configuration is exceeded. Note from the diagrams following how the angle of attack may differ from the pitch attitude.

a = Angle of Attack — angle between the relative wind and the wing chord.

b = Pitch attitude — angle between the nose and horizon.

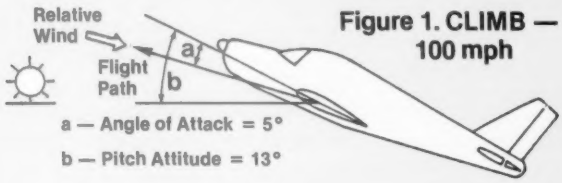
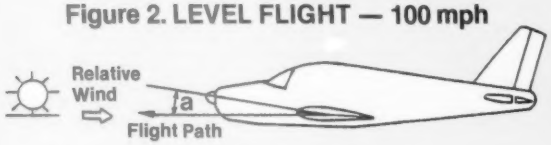


Figure 1. CLIMB — 100 mph

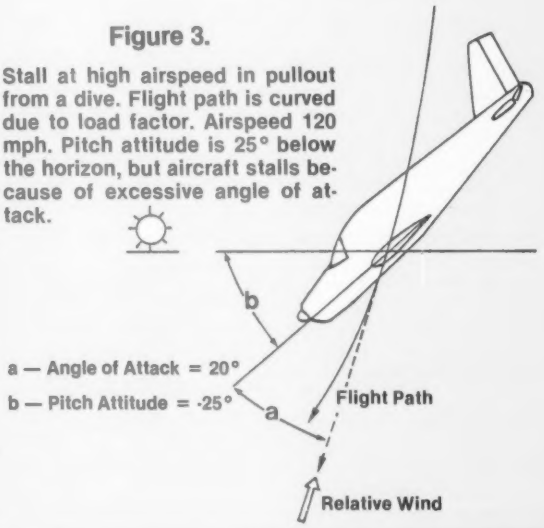
Figure 2. LEVEL FLIGHT — 100 mph



a — Angle of Attack = 5°
Pitch Attitude = 5°

Figure 3.

Stall at high airspeed in pullout from a dive. Flight path is curved due to load factor. Airspeed 120 mph. Pitch attitude is 25° below the horizon, but aircraft stalls because of excessive angle of attack.



(continued from page 5)

dren, terrain surveillance, worried or sick passengers, weather or navigation problems, concentrating on checklists singlehandedly, etc.

In 1976, a *Taylorcraft* pilot, desiring to land at a friend's tree farm, surveyed the area carefully for prospective landing sites, making several low passes to determine the safest runway. However, while pulling up and turning to start his approach, he apparently neglected to also check his airspeed. The aircraft stalled in the turn and crashed, seriously injuring the pilot.

Most aircraft, when trimmed and rigged properly for straight and level flight at altitude, are fairly stable. But during a climb or descent, or in any maneuver when the airspeed is low and the angle of attack is high, much of that stability is lost. A very slight increase in the angle of attack can bring on a stall. Remember that the angle of attack is not necessarily related to the horizon but to the "relative wind"—it is the angle between the wing chord and the relative wind. An aircraft with its wings level to the horizon could be experiencing a zero angle of attack or a very high angle of attack, depending upon whether the aircraft was maintaining level flight, climbing or descending.

Since most light general aviation aircraft do not have attitude indicators, the airspeed indicator is the primary instrument for stall avoidance—but other instruments are important and should be scanned as well. The key word there is *scanned*, rather than watched or stared at.

The common error is to stare at a single instrument. For example, during a turn the unseasoned pilot may fix his eyes exclusively on the turn indicator, in order to assure the quality of the turn and keep the ball centered. This fixation, with disregard of aircraft altitude, airspeed, etc., could lead to a stall.

Scanning has been defined as the "continuous, systematic observation of the flight instruments."In general use this means moving one's attention back and forth between the aircraft, the instruments, and the outside environment.

A good VFR scan should take the pilot's attention from the left horizon to the instrument panel, to the right horizon, and back at least once every 15 seconds. His head need not swivel with the clocklike precision, or the timing or pattern may vary: what counts is that the scan is systematic and continuous, at all times. When something happens to distract him, he simply includes the distracting feature as part of his scan, but never rivets his attention on any distraction for more than a few seconds at a time.

Stall awareness is simply part of the habit of overall awareness. Some have it, and some need a little practice.□

QUIZ

1. Most stall/spin accidents occur
   a. during practice of intentional spins
   b. in the traffic pattern (takeoff, approach and landing, go-around)
   c. when practicing intentional spins in aircraft not certified for them
   d. when practicing stalls
2. An airplane stalled in a left turn tends to spin
   a. to the left
   b. to the right
   c. cannot be determined from information given
   d. in a direction dependent on rudder position when the airplane stalls.
3. Aircraft certificated in the normal category
   a. are approved for intentional spins
   b. have been tested in a six (6) turn spin
   c. will always recover from a spin
   d. are not required to be tested in a fully developed spin

Answers to Quiz 1. b 2. c or d 3. d

Pilotage

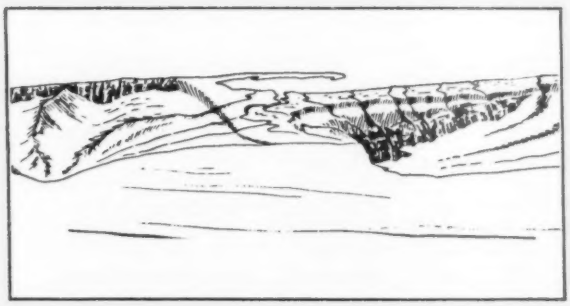
Reading terrain tracks on charts

The ability to interpret terrain relief features shown on sectional charts is important for the safety of all pilots, but it can be critical for those who fly over mountainous or other rugged terrain. Without such ability, the possibility of getting lost, when radio navigation guidance is not available; or of getting caught in unexpected downdrafts through failure to anticipate terrain effects on air movement, is greatly increased. This is especially true when the land features are obscured by brush, trees, snow, weather or darkness.

Most pilots are aware of the fact that shades of green, brown, and yellow are used to depict 1,000 to 3,000 foot gradations of elevation above sea level, and that contour lines can show from 100 to 500 foot differences in elevation depending on the Sectional or WAC chart being used. However, knowing such facts and being able to visualize with some degree of accuracy the terrain aspect indicated by a mass of curving or squiggly lines, while busy flying an aircraft through less than glassy smooth air, is another matter.

For example, before you turn this page upside down, study the relief drawing shown below carefully for a moment and conjure up a picture of what you would expect to see, corresponding to this area on the chart. Then compare your imaginary rendition with the artist's version. If your own effort is disappointing, you can make an interesting game out of practicing this art, while flying over open country. Some individuals are naturally more "visual-minded" than others, but surprising improvement can be made by everyone with practice.

Next, cover the column at left and see if you can interpret the symbol or drawing that depicts the subject indicated on sectional charts.□



DOUBLE TRACK RAILROAD (Single track has single line spacer)	
TUNNELS — ROAD AND RAILROAD	
FORESHORE FLATS Tidal flats exposed at low tide.	
ROCKS—ISOLATED Bare or Awash	
REEFS—ROCKY OR CORAL Label Appropriately	coral
DEPRESSION Illustration includes mound within depression	2000 1000
LAVA FLOWS	
SAND OR GRAVEL AREAS	
SAND DUNES	
ESCARPMENTS, BLUFFS, CLIFFS, DEPRESSIONS, ETC.	

MOUNTAIN PASSES	12632
POWER TRANSMISSION LINES	
PROMINENT FENCES	
OUTDOOR THEATER	
NON-PERENNIAL (dry, intermittent, etc.) Illustration includes small perennial lake	
WET SAND AREAS Within and adjacent to desert areas	
SUSPENDED OR ELEVATED AQUEDUCT	
TUNNELS	
CANALS Label as required	
SMALL CANALS AND DRAINAGE/IRRIGATION DITCHES Perennial	
SWAMPS, MARSHES AND BOGS	

The Uses and Abuses of Airborne Radar

Unrealistic dependence upon this valuable flight aid makes it a two-edged weapon

With the introduction of in-the-wing installations as well as under-the-prop mounted radar for single engine airplanes, weather radar is now available to most types of general aviation aircraft equipped for IFR operations. Beyond question, airborne radar can greatly enhance the safety of flying in instrument weather if—and this is a very large IF—the pilots using this equipment understand how it is to be used and what it is to be used for. If they do not, this invaluable tool can be turned against them, with disastrous results.

The DC-9 accident in Georgia in 1977, mentioned in our July/August article on thunderstorms, is a shocking case in point. According to the investigation report of the National Transportation Safety Board, the aircraft was flying in heavy rain and hail, with the flight crew studying the airborne radar scope hoping to find a "hole" in the storm. At one point they saw what appeared to be an opening in the storm on the scope, and turned toward it, only to encounter even heavier precipitation and turbulence, which damaged the aircraft, caused the engines to flame out, and eventually led to a fatal crash. Scientific studies, the Safety Board noted, show that X-band frequency radar (airborne type) is comparatively susceptible to attentuation ("scattering of returns") by water falling near the antenna. If a pilot fails to consider this limitation, he may misinterpret the display and "see" an apparent opening where none exists, which is one significant reason why airborne radar should *not* be used as a storm penetration aid.

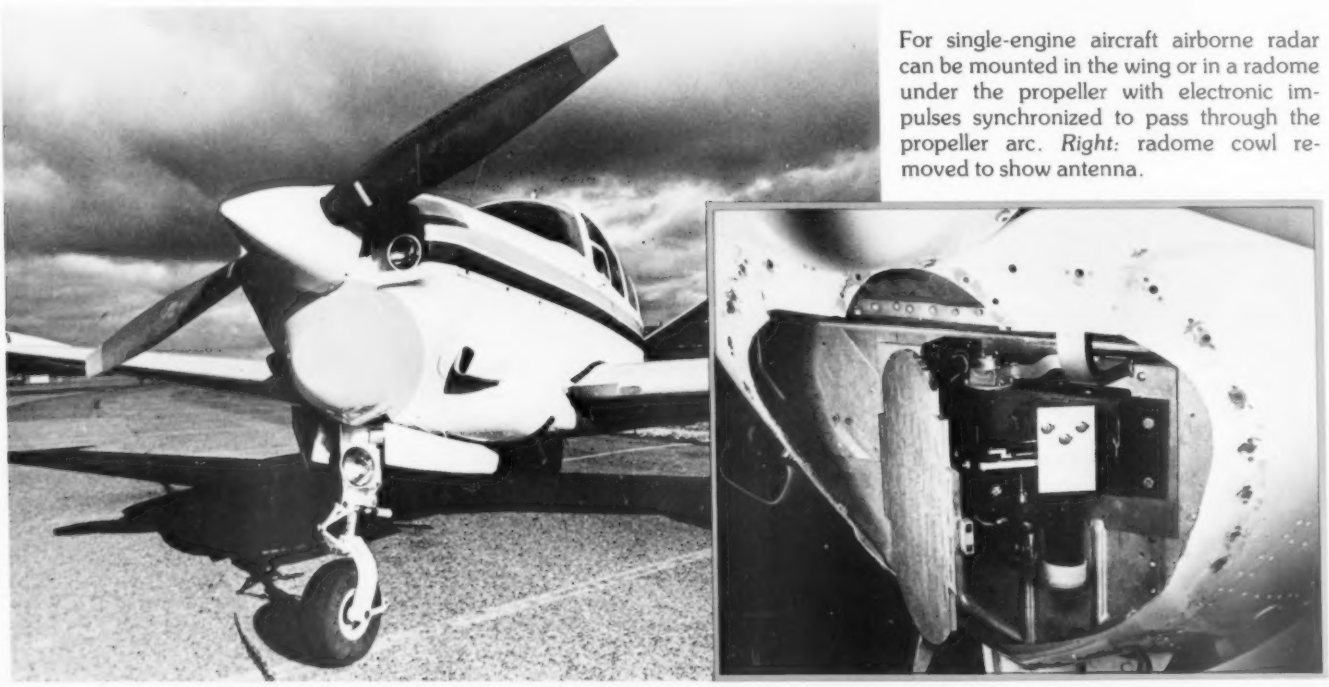
As with most electronic equipment that one buys new, airborne radar is accompanied by an operating manual that is more or less understandable to the average pilot. This booklet requires more than a brief perusal. Before the radar can be used safely and effectively, the instructions must be understood clearly in all details and absorbed into the mind. The procedures should first be carried out in non-stress conditions, in the presence of an instructor or other pilot who is thoroughly familiar with the equipment. Radar is never a direct presentation of a visible object, and the images it projects when weather mapping are never shown as a simple Go/No-go signal. What the pilot sees on the scope must always be interpreted. Intelligent interpretation begins with an understanding of how the equipment works, what it can tell you, and what it cannot tell you.

Like ground-based radar, airborne radar consists basically of an oscillating antenna, a microwave transmitter/receiver, a panel display, and controls. The antenna is located in the nose cone behind radar transparent fiberglas in multi-engine airplanes, or in the wing in single engine planes. The transmitter generates radio frequency energy in the "X" band range (9345 to 9405 megahertz). Earlier radars transmitted in the lower frequency "C" band, (5350-5470 megahertz).

For weather detection the energy is focused by the antenna into a narrow pencil-like beam and radiated out toward possible targets, which reflect some of the energy back to the receiver. The weather signal is designed to be reflected by some form of *precipitation only*: primarily rain or moist hail, usually not snow (unless very moist) or icing, and never clouds or turbulence or airplanes. The reflected energy is processed electronically in a manner which measures the rate of rainfall. The rainfall density is displayed in one of three categories, represented on the display by three different shades of green (or by three separate colors, with full color radar). The deepest shade of green represents very heavy rainfall—over half an inch per hour.

In older equipment the picture changes with each sweep of the radar antenna but more modern equipment offers a continuous viewing display similar to your television picture and readable under ambient light without a hood. (Note: Because of the optical filter used with such displays, some types of sunglasses, especially polarized glasses, may give a distorted effect.)

In order to further define contrasting



For single-engine aircraft airborne radar can be mounted in the wing or in a radome under the propeller with electronic impulses synchronized to pass through the propeller arc. *Right:* radome cowl removed to show antenna.

ENTER MY SUBSCRIPTION TO FAA GENERAL AVIATION NEWS for one year @ **$6.20**. Add **$1.55** for foreign handling.

Send Subscription to:

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

PLEASE PRINT (FAN–File Code 2F)

NOTE: Prices are subject to change without advance notice. Allow 1 to 3 months for processing.

MAIL ORDER FORM TO:
Assistant Public Printer
(Superintendent of Documents)
Government Printing Office
Washington, D.C. 20402

☐ Remittance Enclosed (Make checks payable to Superintendent of Documents)

☐ Charge to my Deposit Account No. _____

For NEW subscribers only. Do not use for renewal of subscription, unless expired.

Keep in touch - Get a Bi-monthly briefing from FAA by mail

DETACH ENVELOPE HERE ENCLOSE LETTER WITH CHECK OR MONEY ORDER (DO NOT SEND CASH)

PLACE
STAMP
HERE

ASSISTANT PUBLIC PRINTER

(Superintendent of Documents)

Government Printing Office

Washington, D.C. 20402

areas of precipitation, modern radars have an alternate circuitry known as "iso-echo" or "contour" mode. When energized by the contour switch, this circuit alters the normal radar presentation by cancelling out the returns in the areas of heaviest rainfall which then appear as black "holes." *Warning:* Careless pilots have interpreted such black areas as openings in the storm, instead of correctly seeing them as centers of intense activity. Some radars are able to call attention to these areas by flashing the dark spots off and on.

Although, superficially, these presentations are something like the contour lines on a topographical chart, they are not read nearly as easily. In the first place, what the pilot is seeing are areas of *precipitation*, not turbulence—which is what he is most concerned about. And the size of the dark or deep green areas is not so much a concern as the *distance between the areas of light precipitation and heavy*. The shorter the distance between varying degrees of rainfall, the more turbulent the area is likely to be.

The pilot must remember that he is looking at a cross section, or horizontal slice of weather, which is presented to him vertically, and the rainfall 'map" he views is by no means necessarily identical with the present picture of up and down drafts. The large black areas shown him by contour displays confirm the presence of active storm cells without precisely defining them. The information gained is intended to be used as a means of detouring around storms, not for passing in between storm cells, or venturing within 15 miles of associated storms in a frontal system. *No radar or non-radar weather detection systems in existence are capable of steering you safely through an active storm area, and none makes that claim.*

Once an aircraft is engulfed by a storm cell, the radar on board may be of little use in finding a way out. The effect of attentuation, described earlier, makes the accuracy of any display when actually experiencing rain or hail very suspect. An accumulation of ice on the radome or hail damage to the radome also produces a distorted picture. Pilots can take advantage of the long range viewing capability of radar to give severe weather a wide berth.

If your radar does not have automatic antenna stabilization, the antenna tilt knob must be used when the pitch angle of the aircraft changes to avoid losing sight of storm activity ahead. Be aware that in a turn you may need some slight additional adjustment if your antenna is not automatically stabilized. The motion of a turn tends to position the antenna beam too high on the outside of the turn and too low on the inside.

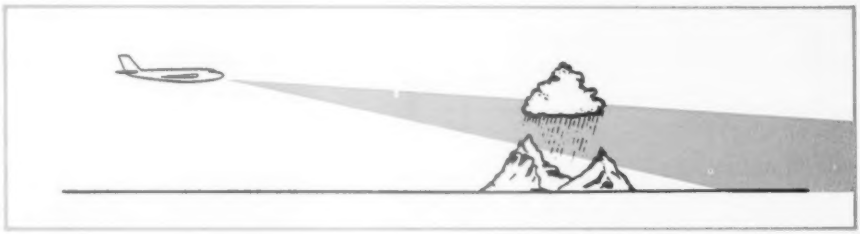
Tilt management, when antenna stabilization is automatic, consists of adjusting the antenna's vertical tilt angle to maintain a constant weather scan in various pitch attitudes, and for separation of weather and ground targets. The normal position of the antenna is horizontal, but in preparing for takeoff the tilt may be raised sufficiently to clear the airport ground clutter and plan a departure route with respect to any existing weather. (This is particularly important at airports without radar ground stations, where observation of strong local echoes could result in departing from a different runway or delaying a departure.) During a prolonged climb to altitude, it may be advisable to adjust the antenna tilt several times in order to accomplish a vertical scan of cloud buildups. Upon reaching cruise altitude, the antenna tilt should be adjusted to just above the angle of ground returns, with the exact setting dependent upon the pitch attitude of the aircraft and the evenness of the terrain.

The term "line of sight range" with respect to radar needs to be understood. The vertical scan of the radar increases, obviously, with distance, but at a given point (depending upon altitude and tilt angle) the floor of the scan will intersect the terrain. This means that any weather formations beyond this point, and below the floor of the scan, will not be painted on the radarscope. The lower the tilt angle, and the lower the altitude of flight, the shorter the line of sight range.

Conversely, if too high a tilt is maintained, low level storm clouds could move laterally across the intended flight path without being detected.

Some pilots like to keep their antenna well clear of the surface in order to spare themselves the sometimes annoying task of separating weather targets from ground targets. Separating weather from ground returns is something every radar equipped pilot must learn, however, because it is a frequent problem. For example, when a storm cloud is located over a mountain range, and the radar beam is centered on the rainfall shaft of the storm, the storm cell may be masked on the scope by ground targets. Appropriate tilting of the antenna will show the weather targets in a much brighter shade of green than the ground. Also, remember that the displayed angle of ground returns will increase, and the intensity of the returns will decrease, as the tilt angle is raised. This is not true of weather returns which are reflected from vertical targets. Another means of discernment is based on the limited range of ground returns at different aircraft altitudes. At 5,000', for example, the limit for terrain mapping is about 70 n.m. In point of fact, most strong radar returns in general aviation aircraft at a point that is from beyond the line of sight range, or farther than 75 n.m., can be considered as weather targets.

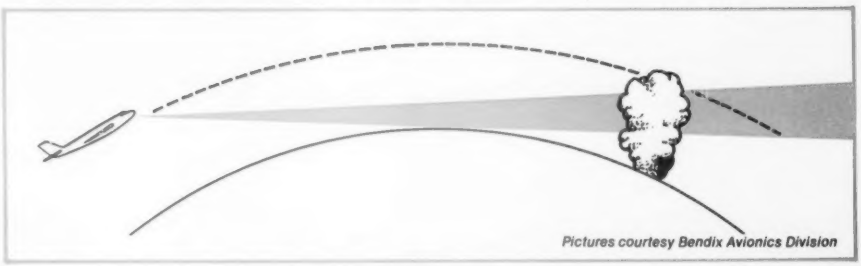
Tilt management, together with gain control, is also important when using the terrain mapping mode of airborne radar. For



Above — significant weather will show as a brighter shade than ground return at shallow tilt angles.

Left — weather target will show as a solid mass; mountains will show a gap behind the peaks.

Below — if a target is shown at or beyond the line-of-sight range, chances are good it's a weather target.



Pictures courtesy Bendix Avionics Division

example, in flying over a mirror-smooth body of water or very even desert, the radar energy is reflected in a forward scatter with very little return. The result can be "no target." Lowering the antenna tilt (or increasing the angle of incidence) can bring about sufficient echoes for presentation. On the other hand, if the aircraft is known to be flying over a body of water, a fairly good estimate of the surface activity of the water can be made as a result of examining it with varying antenna tilts. With appropriate use of the gain control (which varies the intensity of the targets displayed) a pilot can learn to identify rivers, mountains, shorelines, and ships on his scope.

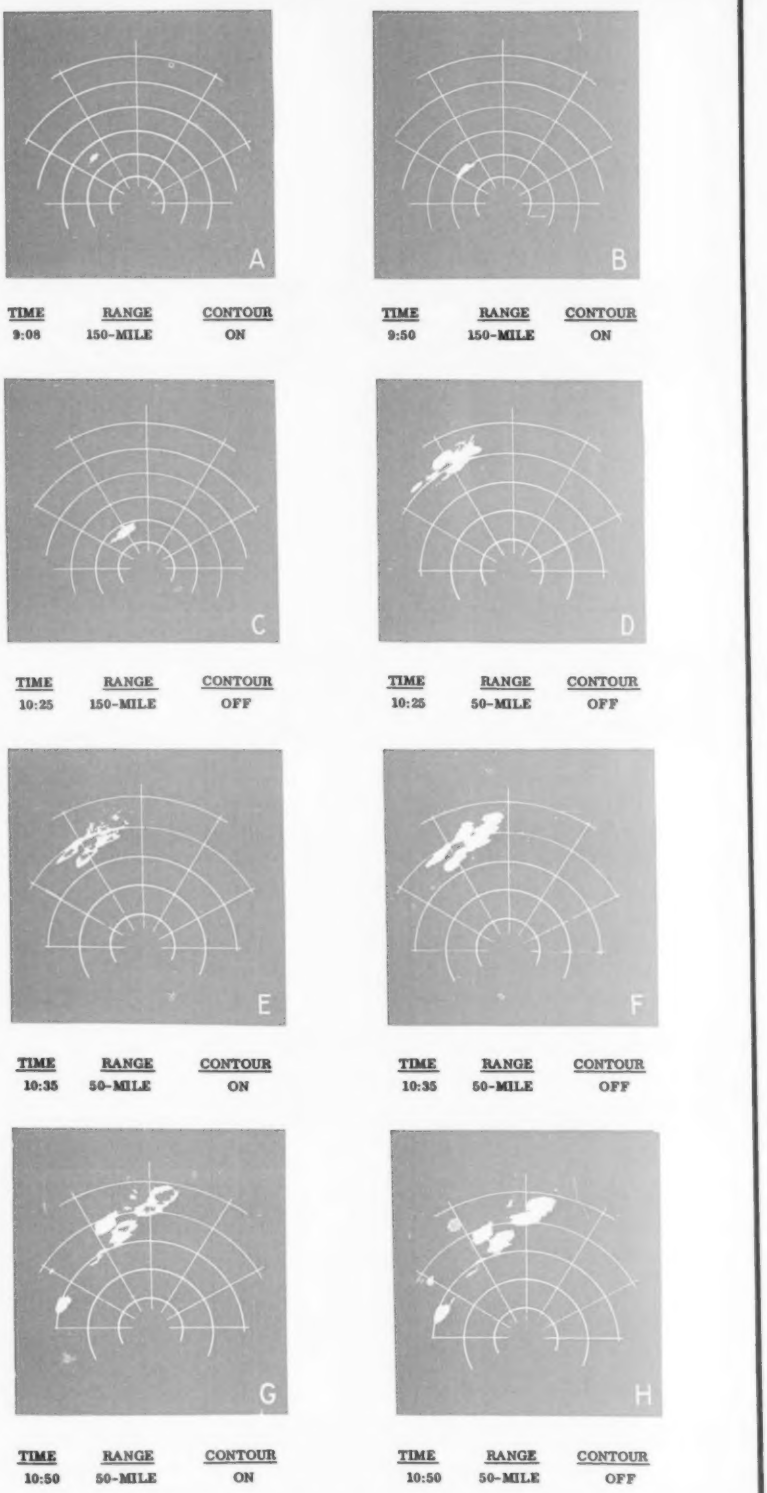
Other discrete objects, which are not clearly deliniated, include hail, tornadoes, snow, and lightning. However, pilots who are thoroughly experienced in reading radar are able to detect evidence which indicates these phenomena are likely to be present. The presence of hail, for example, is suspected whenever targets (seen in the contour mode) suddenly assume bright and distinctive forms usually described as (1) fingers, or protrusions, (2) hooks, (3) scalloped edges, or (4) U-shaped pendants suggesting the numeral 6. Crescent-shaped indentations are also indicative of hail or snow. Lightning or static discharges will momentarily scatter the displayed returns.

The more experience pilots have with reading weather radar, the more they are likely to realize how misleading the displays can be if one is not thoroughly and currently briefed beforehand on weather conditions. The mis-use of airborne radar begins with reliance upon the instrument as an

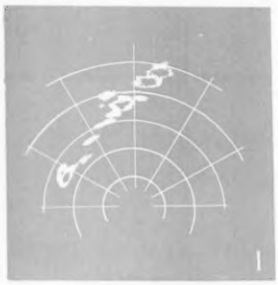
Radar Maintenance

Radar equipment, like most avionics, is sensitive to overheating, humidity, and impact forces. Repairs or installation may only be performed in an FAA-approved repair station having radar qualification. Some understanding of the importance of the installation may be gleaned from the fact that components of a basic airborne weather radar set can be bought for under $2,000, whereas complete installation costs will drive the minimum price up to about $10,000.

Except when used in commercial operations, airborne radar is not subject to mandatory overhaul or inspection other than the annual inspections. *The pilot is responsible for assuring that his equipment is functioning normally.* A malfunctioning radar can lead to weather entrapment and possible encounter with severe weather.

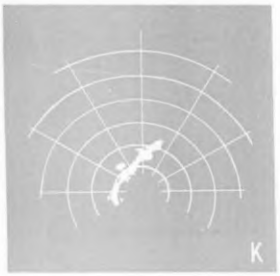


RADAR SCAN IN CONTOUR MODE

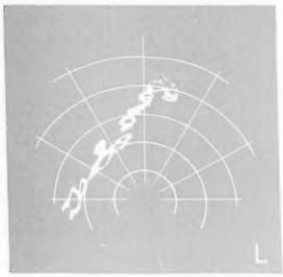


TIME	RANGE	CONTOUR
11:00	50-MILE	ON

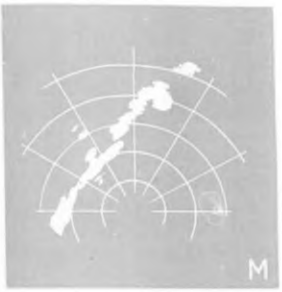
TIME	RANGE	CONTOUR
11:00	50-MILE	OFF



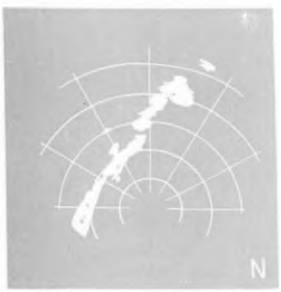
TIME	RANGE	CONTOUR
11:10	150-MILE	ON



TIME	RANGE	CONTOUR
11:10	50-MILE	ON



TIME	RANGE	CONTOUR
11:13	50-MILE	OFF



TIME	RANGE	CONTOUR
11:15	50-MILE	ON

(Contour Turned Down)

TIME	RANGE	CONTOUR
11:20	20-MILE	ON

TIME	RANGE	CONTOUR
11:40	150-MILE	ON

SHOWS ILLUSORY "HOLES" IN STORM

all seeing eye that will guide the aircraft safely through any kind of weather. The displays are too easily misinterpreted for that, especially given the impetus of a desire to complete a flight as speedily as possible. Reception can be distorted, as noted earlier, by precipitation and icing, by mechanical failure, poor maintenance, turbulence, or any of a number of pilot errors. The installation of airborne radar, no matter how sophisticated, can never relieve a pilot of the weather briefing aspect of preflight planning.

In fact, the primary safety usage of airborne radar is to cope with abrupt en route changes in forecast weather, when flying at night, and especially when flying on instruments in a cloud layer where the formation of storm clouds is not visible to the naked eye or when approaching suspicious looking clouds that pop up along one's flight path. By taking into consideration his weather briefing, his visual sightings, recent pilot reports and SIGMETS, *and* his radar display, the pilot is in a good position to make sound decisions about continuing the flight, detouring, seeking another altitude, or turning back—rather than relying solely on ground-based radar or hunt-and-hope guesswork.

Airborne Radar Warning Label

RADIATION:
Warning: this instrument generates microwave radiation. Do not operate until you have read and carefully followed all safety precautions and instructions in the operating manual. Improper use may cause serious bodily injury. Caution: when transmitters are operated out of their protective case, X-rays may be emitted.

In addition to seeing that the manufacturer's maintenance recommendations are carried out, the pilot has the responsibility for checking out his radar equipment before each flight. Most equipment has a test mode for checking on shade or color resolution, range definition, and absence of noise. *Note:* the test mode is the only one that should be used whenever the aircraft is on the ground in close vicinity to persons or obstructions. In all other modes the energy radiated by the equipment can be injurious to persons at close quarters, or to the transmitter/receiver itself, and inflammable or explosive material could be ignited. Before taking off the tilt knob should be operated to assure antenna response to manual control. The automatic stabilization feature, if present, should also be checked at altitude periodically, as indicated in the owner's manual.□

Bryan Allen, *Pilot*

Famous **FLYERS**

MacCready's Albatross

Paul MacCready, *Designer*

Across the channel in a human-powered aircraft

Legend has it that human flight began some 2500 years ago when Daedalus, a legendary Greek imprisoned on the island of Minos by a tyrant king, escaped over the wall of his prison by means of wings made of bird feathers. His flight was successful, as was that of his co-prisoner and son, Icarus, but the youth sailed too long and too high in the thermals and crashed when the sun softened the wax that held his wingfeathers in place.

The lure of human-powered flight continued to intrigue potential aviators over the centuries, despite the conclusions of Leonardo da Vinci and other serious thinkers that, anatomically, man simply did not possess the muscle-to-weight ratio that enabled birds to fly.

Every imaginable contraption was designed, and many were built and tried, but none showed even a glimmer of success until August 23, 1977 when an ungainly, huge-winged aircraft rose from the desert sands of California to make the first officially recorded successful flight entirely *under human power* over a prescribed course following takeoff from level ground. The craft was named after the rare California Golden Condor whose long-winged configuration it resembled and for its transparency: *Gossamer Condor*. The flight won for the pilot and the designer/builder a prize of nearly $100,000.

The modern-day Daedalus was Dr. Paul MacCready, Jr., 53, a Navy-trained pilot, one-time international soaring champion, and holder of a Doctor of Philosophy degree in Aeronautics from the prestigious California Institute of Technology. In recent years, Dr. MacCready has been head of Aerovironment, Inc., a firm which designs drag reduction devices for land vehicles.

His "Icarus" was a protoge, Bryan Allen, 26, a hang glider flyer and champion bicycle racer with a college degree in biology.

The third member of this modern trichotomy was Henry Kremer, a British aerospace industrialist and health devotee, who decided the time had come to end the myth of human limitations regarding human-powered flight. Another Briton, Roger Bannister, had recently, through hard work and equally hard study, broken the supposedly impregnable four-minute mile barrier. Kremer tantalized the aviation industry and stimulated ultra-light aviation technology by offering a prize, worth at one point $150,000, for the first human-powered flight over a prescribed figure-eight course one mile long.

Many thousands of man-hours were devoted to dozens of competing team efforts to win this prize. The front runners came from Great Britain, the United States, and Japan. Some designs actually flew but could not overcome the obstacle of turning. Some turned too well and forced wings to collapse. Some merely collapsed from their own weight before ever leaving the ground. By 1977, when Dr. MacCready's dark horse, the *Gossamer Condor*, appeared, the competition was at a standstill.

By now it had been generally accepted that leg power, linked to a propeller by means of bicycle-type pedals and chains, was the best means of human propulsion. In Bryan Allen, a six-foot, 136-pound bicycle racing champion, MacCready had an ideal pilot for his aircraft, one who combined maximum strength with minimum weight. Like other modern engineers, MacCready took advantage of newly developed plastics and other lightweight materials for his aircraft.

For example, he found that the sheet plastic Mylar (similar to that used to wrap meats in the supermarket) was strong enough to use at a thickness of .0005 inches, weighing .0033 pounds per square foot. (Grade A aircraft fabric weighs 2.5 pounds/ft^2 and sheet aluminum used in light general aviation aircraft .33 pounds/ft^2.) Two and one-half pounds of Mylar covered the entire aircraft. Other materials included corrugated paper for leading edges, piano wire for rigging, an aluminum tube framework, balsawood ribs, and styrofoam propeller—all "off the shelf" items and readily available.

Like other competitors for the Kremer prize, the *Condor* had an enormous wingspan—96 feet, outspanning the DC-9. The swept wing stood 10 feet off the ground, supported by a 30-foot fuselage. A 15-foot "foreplane" was positioned forward by means of a narrow bowsprit. Empty weight of this gargantuan bird was a mere 70 pounds. Total wing area was 835 square feet.

Probably the key to MacCready's success where all others had failed was his perception that a low-flying, human-powered aircraft, with its necessarily extensive wing, should not be steered by a conventional rudder. He invested control instead in the foreplane, which not only maintained lateral stability of the aircraft by means of ailerons but also initiated the very shallow (3°) bank needed for turning. Bank angle was also maintained by reverse warping of the wings —i.e., the lower wingtip was warped to in-

crease the angle of attack, in part to compensate for the much lower airspeed and lift generated at this point of the huge wing.

Test flying of the *Condor* began early in 1977, with MacCready's teenaged sons (both veteran hang-glider flyers) serving as the original pilots. Although the human power output required for the aircraft was a minimal .45 hp for seven minutes, MacCready soon concluded that the services of a trained bicycle racer was desireable, and he recruited Bryan Allen to the project. Voluntary assistance in many forms was provided by a team of devotees made of relatives, employees, and well-wishers—most of whom were eventually given a chance to fly the aircraft.

The essential technique of flying an ultralight plane at slow speeds, as MacCready soon learned, was developing a bird-like sensitivity to the slightest fluctuations of air currents. Time and again, pilot reactions were too slow, resulting in stalls and crashes. No injuries—but endless hours of repair and rethinking. MacCready now understood why da Vinci had given up after eight years of trying to build a flying machine.

MacCready's moment of triumph came on a calm morning on the desert near Bakersfield, Cal., when after six months of trials and errors, the *Gossamer Condor* wafted its way around the prescribed course in the presence of official witnesses, covering 1.35 miles in seven minutes and 27½ seconds, with an airspeed ranging between 10 and 11 mph. The Kremer Prize had been won at last. Paul MacCready received world wide applause and a Distinguished Service Award from FAA.

The *first* Kremer prize, that is. Ink was hardly dry on the check before the donor had announced an offer of twice that figure ($200,000) for a human-powered flight across the English Channel. This would indeed be a test of endurance. The distance was at least 20 miles, the Channel was noted for violent winds, and the aircraft was not designed to land on water. Nevertheless, after a short huddle with his team, MacCready set to work on a modification of the *Condor* which he felt would fly from England to France.

The building of this new *Gossamer Albatross* began in much the same manner as had the *Condor*—with simple materials and with everybody pitching in. Quickly, however, MacCready's practiced aeronautical mind told him that for Bryan Allen to be able to pedal *Albatross* across the English Channel, weight would have to be reduced substantially; to accomplish this, some unusual materials would be needed, and the cost of these materials would be a problem. This is when a *deus et machina*, in the tradition of ancient Greece, in the form of the Du Pont Co. stepped in and offered to supply the exotic materials in exchange for some advertising—Du Pont's name on the *Albatross* when the flight was made and the services of Bryan Allen later for promotional purposes.

The *Gossamer Albatross* had essentially the same specifications as the *Condor* except for the crucial factor—weight. The *Albatross* weighed only 55 pounds, a reduction of nearly 30%. Carbon filament tubing replaced the aluminum, and an improved Mylar which held the shape of the wing better was used. An upright pedaling position was found to be more conducive to control and easier on the pilot. (*Condor* had been flown in the more strenuous semi-reclining position.) The average wing chord was five and one-half feet, reduced from 10 feet in the *Condor*. With the reduced weight, less wing area was needed for lift, and the narrower wing made control easier.

The longest *Albatross* test flight in the United States was 69 minutes, covering 13 miles, half the distance required. In England, prior to the channel flight attempt, Allen kept in shape by flying 10 to 15 minutes a day, going up only under perfect meteorological conditions for the aircraft—calm or no winds in the early morning hours. All test flights were made over land because it was too expensive to get the safety boats and crews out for an overwater run.

The perfect day — clear, no wind — dawned on June 12, 1979. The team assembled at Folkestone to ready the aircraft and prepare a deployment of surface vessels to clear Allen's path of traffic and follow in his wake. Just after sunrise, Allen began pedaling down the creaky wooden dock. *Albatross* promptly tilted to its side and settled on one wing. Fortunately, there was no damage to either the aircraft or pilot, so they tried again. This time Allen and *Albatross* took to the sky.

MacCready followed the progress of the flight from the radar-equipped small boat, *Lady Ellen Elizabeth*. His navigators watched radar scopes and plotted Allen's course across the Channel. They remained in constant radio contact with him, encouraging him, advising him of shipping traffic, and giving course corrections. Allen wore swimming trunks, a bicyclist's crash helmet, and life vest.

Half an hour into the flight, the weather turned against Allen. The contrary winds the English Channel is famous for began to blow directly into his face, and MacCready's hopes waned. He estimated the power required to keep the aircraft airborne increased 25% at the onset of the headwinds, which decreased Allen's ground speed at times to only three miles per hour. Two hours went by, and he was only three-quarters of the way across the Channel.

Because of the extra horsepower Allen had to come up with, his strength lagged and his legs began to cramp. During the final third hour of the flight, there were times when the aircraft, just six inches off the waves, was threatened with a watery burial. MacCready was now doubtful of completion; he felt they were aloft on borrowed time.

Even when the French coast was clearly in sight, MacCready was not ready to celebrate, knowing how spent his pilot must be. Gliding the final few yards to the beach, a weary Allen and an undamaged *Albatross* touched safely down at Cap Gris Nez, France. Allen had averaged 10 to 15 miles per hour, covering the approximately 25 miles in just under three hours. This modern Icarus, who had flown low and cool the whole way, was overcome only by the exhileration of success.

Full realization of their conquest only came to Allen and MacCready several days later at the Paris Air Show when they suddenly thought to themselves, "We really did it! We actually flew across the Channel!" Their aircraft was a star attraction at the famous air show.

As for the future of their pedal plane, MacCready does not know if there is enough interest to market a homebuilder's kit for human-powered flying. The cost of the materials—especially the carbon filament tubing—is prohibitive. The aircraft itself "needs to be simplified and made stronger with less expensive materials before it can be marketed, and it does require some skill to build." However, both Allen and MacCready feel that eventually a kit for a smaller version of their aircraft, perhaps called the *Gossamer Penguin*, could become a reality. The low altitudes and airspeeds involved could make this the safest form of sport flying.

MacCready is now at work on the design of a truly solar-powered aircraft, one where the solar cells directly operate an electric motor without the use of storage batteries. If a sponsor can be found for the project, MacCready will reassemble the *Condor*/*Albatross* team, including Allen, to solve the challenge of sun-powered flight.

Henry Kremer, now in his 60's, lives quietly in retirement on the Isle of Man, off the west coast of England. His challenge well met, his dream now true, he has announced no new cash prizes for human-powered flight. But who knows? London to Paris? Across the Atlantic? There are no limits to a dream. □

SKIRTS ALOFT. The number of women holding pilot certificates has doubled in the past 10 years, increasing at the rate of over 1,000 issuance per year. In 1977 there were 21,589 women holding private pilot or higher certificates, as compared with 10,456 women pilots in 1967. Their ranks included women of all ages and occupations.

PROPOSAL TO LIMIT 'COPTER NOISE LIMITS OPEN FOR COMMENTS

Civil helicopters will have to meet federal noise standards if a proposed rule published in the July 19, 1979 *Federal Register* become law. The rule would apply only to newly certificated helicopters which would have to meet the noise criteria before certificate approval.

The proposal would apply to all new helicopters off the assembly line regardless of when the aircraft were type certificated. All helicopters not flown before January 1, 1985 would be required to meet the noise level limits. The rule would prohibit any design change to already flying aircraft which would increase their present noise levels.

The noise limits proposed by FAA are keyed to the maximum certificated weights and performance capability of helicopters, and, the standards are comparable to those for fixed-wing aircraft. The highest noise limit, applied to maximum gross weights of 176,370 pounds, is 107 EPNdB (Effective Perceived Noise) Decibels. This level is approximately the noise effect of an air hammer at three to five feet.

Send comments to FAA, Office of the Chief Counsel, ATTN: Rules Docket (AGC-24) Docket No. 13410, 800 Independence Ave., S.W., Washington, DC, 20591. Deadline: November 19, 1979.

IDENTIFICATION DATA RULE

Removal of any kind of identification data or changing that data for any part of the aircraft, aircraft engine, propeller, blade, or hub prohibited under Amendment 45-10, effective September 4, 1979. The Amendment was enacted to prevent use of improper identification information on aircraft and aircraft parts. The Amendment appeared in the August 2, 1979 *Federal Register*.

HOMEBUILT CERTIFICATES

In an effort to reduce regulatory burden and save man-hours, the amateur aircraft inspection rules have been changed. Now, once an amateur-built aircraft passes its flight tests and is given its certificate, the builder can be certificated as a repairman for the purpose of conducting the annual inspection with the airworthiness certificate valid for an indefinite period. No longer will the aircraft have to be recertificated each year.

MODERNIZING GA AIRPORTS

FAA Administrator Langhorne Bond recently announced a new program to relieve congestion at major airports by making smaller, nearby "satellite" airports more attractive to general aviation.

The $100 million, four-year program will concentrate on 86 satellite fields in 56 metropolitan areas, but could eventually affect as many as 236 airports in 75 metropolitan areas.

FAA will give priority to such projects as installation of instrument landing systems, visual landing aids, and automated weather-reporting equipment. Construction work will focus on improving runways, taxiways, and parking aprons. No new control towers are included in the program; however, traffic will be monitored and tower service established where needed.

PENALTIES ENFORCED FOR REPEATED VIOLATIONS

The Aviation Safety Reporting System, which encourages voluntary reporting of flight incidents involving unsafe conditions, has been modified to enable enforcement procedures to be taken against persons who deliberately and repeatedly misuse the "immunity" feature of the reporting system.

The modified system still provides for all reports of unsafe conditions to be sent directly to NASA, instead of FAA for processing and analysis. The sender's anonymity is protected through "de-identification" (except when reports discuss criminal offenses or accidents).

However, FAA will no longer regard a report as grounds for immunity if the person involved has previously been found in violation since the beginning of the Aviation Safety Reporting Program in 1975.

Also, the previous policy of allowing a single report of an unsafe incident to make all persons involved eligible for immunity from enforcement procedures has been eliminated. Now each individual who wishes such consideration must file a report with NASA within 10 days of the occurrence.

All FAA inspectors will retain full authority to investigate any incident in which flight safety was apparently jeopardized which comes to their attention, regardless of whether reports have been filed with NASA. Their findings will be forwarded to the FAA Regional Counsel, who will determine whether an individual qualifies for immunity. The burden of proof that a report was filed with NASA rests with the individual being investigated.

In determining whether any enforcement action will be taken, FAA will consider such factors as deliberate rulebreaking, the certificate holder's level of responsibility, his attitude toward the violation, the actual hazard to others, and the need for special deterrent actions.

The reporting form, NASA ARC 277, with an explanatory Advisory Circular (AC 00-46B, 6/15/79), is available from FAA's local offices.

The NASA form is to be distinguished from the Safety Improvement Report, or "SIR" which is part of FAA's Accident Prevention Program. Also available from FAA field offices, this form is used to suggest improvements to local flying conditions or call attention to existing hazards, such as inaccurate charts, malfunctioning NAVAIDs, weakened runways, ground obstructions, etc.

The two reporting programs overlap to some extent, but in the main the NASA reporting program deals with major and immediate threats to air safety, possibly requiring corrective actions at the regional or national level, whereas the SIR program deals with less serious problems which can usually be settled with local officials.

• Clarifying Identifier Beacons

Oops! Not quite the correct answer to the question about the Midland, Texas "NDB." (Forum, Mar/Apr 79) The facility identified by "362 MA" in the Midland VORTAC identifier box is not the frequency and identifier for the Midland Airpark beacon as you state, but is for the compass locator at the outer marker for the Midland Regional (MAF) ILS. The locator is about six n.m. northwest of Midland Regional Airport and is shown on the San Antonio Sectional by the usual NDB symbol. It has nothing to do with the Midland Airpark (MDD) but it does provide an NDB approach for both Odessa-Schlemeyer Airport, located to the southwest, and for Midland Regional.

Robert W. Hutchins
Albuquerque, NM

Correction accepted with thanks.

• Physiological Training

In your September 1977 issue, you had an article entitled "The Physiology of Flight." At the end of that article you refer to the fact that your next issue would list the facilities where the course that is described may be taken. I would appreciate your current advice as to where that type of course may be taken today.

John F. Russo
Toms River, NJ

The civilian pilot's physiology training course is still available free at the FAA Aeronautical Center in Oklahoma City and at the NASA-Johnson Space Center near Houston, Texas. Application forms, available from FAA field offices, should be mailed to Mike Monroney, FAA Aeronautical Center, AAC-23B, P. O. Box 25082, Oklahoma City, OK, 73125 (Tel. 405-686-4837). The list of military bases requiring a $5 fee are:

Andrews AFB, MD
Barbers Point NAS, HI
Brooks AFB, TX
Brunswick NAS, ME
Cherry Point MCAS, NC
Columbus AFB, MS
Corpus Christi NAS, TX
Edwards AFB, CA
Ellsworth AFB, SD
Fairchild AFB, WA
Jacksonville NAS, FL
Laughlin AFB, TX
Lemoore NAS, CA
Little Rock AFB, AR
MacDill AFB, FL
Mather AFB, CA
Norfolk NAS, VA
Patuxent River NAS, MD
Pease AFB, NH
Pensacola NAS, FL
Peterson AFB, CO
Point Mugu NMC, CA
Reese AFB, TX
San Diego NAS, CA
Shaw AFB, SC
Whidbey Island NAS, WA
Williams AFB, AZ
Wright-Patterson AFB, OH

• Smithy Did Not Do It

We have read with interest your March/April 1979 issue and the story "Smithy." We have noted some lack of historical accuracy in this article, notably the statement that "Smithy" made the FIRST westbound crossing by aircraft is false.

On April 12 and 13, 1928, the first non-stop, westbound, North Atlantic crossing was made by Baron G. Von Huenfield, Capt. Herman Koehl, and Maj. James Fitzmaurice in the Junkers "Bremen," from Baldonnel, Ireland to Greenly Island, Newfoundland. They traversed 2,070 miles in 37 hours. The airplane still exists in the Edison Institute, Henry Ford Museum, in Dearborn, Mi.

Robert L. Taylor
Blakesburg, IA

• ELT Lithium Sulfide Batteries

I have a chromalloy ELT with a lithium battery (ACR/RLB 101 Model 2). Is it possible to get a battery for this ELT that would meet FAA requirements?

Ronald Brockway
Wapello, IA

Negative, at the moment. The current Airworthiness Directive covering Lithium Sulfur batteries in aircraft (79-18-05) prohibits the use of such batteries unless they conform to recently established specifications, as contained in Technical Standard Order C-97, FAR S 37.209, as published in the Federal Register on August 27, 1979. We anticipate it will be at least several months before Lithium Sulfur type batteries conforming to this standard and suitable for your ELT will be on the market—if then. You can check with the manufacturer, or your local FAA District Office.

In the meantime the current Airworthiness Directive permits you to operate without an ELT until March 28, 1980, provided that the aircraft is placarded to indicate the absence of a functioning ELT. Note that ELTs which do not use Lithium batteries are readily available.

• Geography for Pilots

I just read your article on Northwest passages—VFR flying aross the Cascades—and found it *very interesting* (May/June 1979). Have you thought about taking that article and all of your other terrain flying articles and printing them in one booklet such as "The VFR Pilot's Geography Book of the U.S."? The knowledge and talent shared by the author of those articles would be invaluable.

Consuelo Z. Huffman
Westerville, OH

We are not in a position to publish booklets, but we are in process of issuing various terrain flying articles as reprints, which are normally available to you free from your local FAA Flight Standards District Office or Accident Prevention Specialist.

• Post-Crash Security

Your article "Piecing the Puzzle Together" (May/June 1979) was very informative and timely. However the author neglected to mention the role of state aeronautical agencies in post-crash security. State aeronautical inspectors are often the first to secure the scene before the arrival of federal inspectors.

Gordon Bunker
Bow, NH

The work accomplished at accident sites by state aeronautical agencies is known for its thoroughness and dedication. The oversight was unintended.

FAA GENERAL AVIATION NEWS welcomes comments from our readers. No anonymous letters will be used, but names will be withheld on request. Address: FAA GENERAL AVIATION NEWS, AFS-807, Washington, D.C. 20591.

• General Aviation Percentages

In a recent article you indicated personal flying is the largest category of general aviation, with business flying second at 20%. Could you publish a list of all the categories with their individual percentages?

Daniel Sjoberg
Manhattan Beach, CA

In 1977, general aviation flew nearly 36,000,000 hours. The categories and their percentages are as follows:

Personal	*24%*
Business	*19%*
Instructional	*18%*
Air Taxi	*12%*
Executive	*10%*
Rental	*8%*
Aerial Application	*6%*
Other/Industrial	*3%*

• Collision Avoidance Devices

I hear much about equipping aircraft with collision warning devices. What progress has been made so far? What can be expected in the near future? Wouldn't it be every expensive for the average pilot?

Homer Martin
Lake City, TN

FAA has developed three types of collision avoidance systems for use by air carrier aircraft, requiring on board equipment. A notice of proposed rulemaking for collision avoidance systems is expected to be issued in May 1980, with the rule to be published in October 1980. Development of the system is expected to continue through the mid-1980's. No requirement is planned to have general aviation aircraft carry collision avoidance systems. Yes, it would be very expensive.

INSTRUMENT CORNER

• Holding Pattern on Approach

The approach procedure for Mercedita Airport (AL-5248 FAA), Ponce, Puerto Rico specifies a procedure turn. It also depicts a holding pattern over the VOR.

Let's assume that an aircraft is cleared for the VOR approach while still en route. Let's say that the pilot reaches the VOR at 8,000 feet.

May the pilot elect (after advising ATC) to descend on the holding pattern without flying to the procedure turn and to not descend below procedure turn altitude until established on the inbound track?

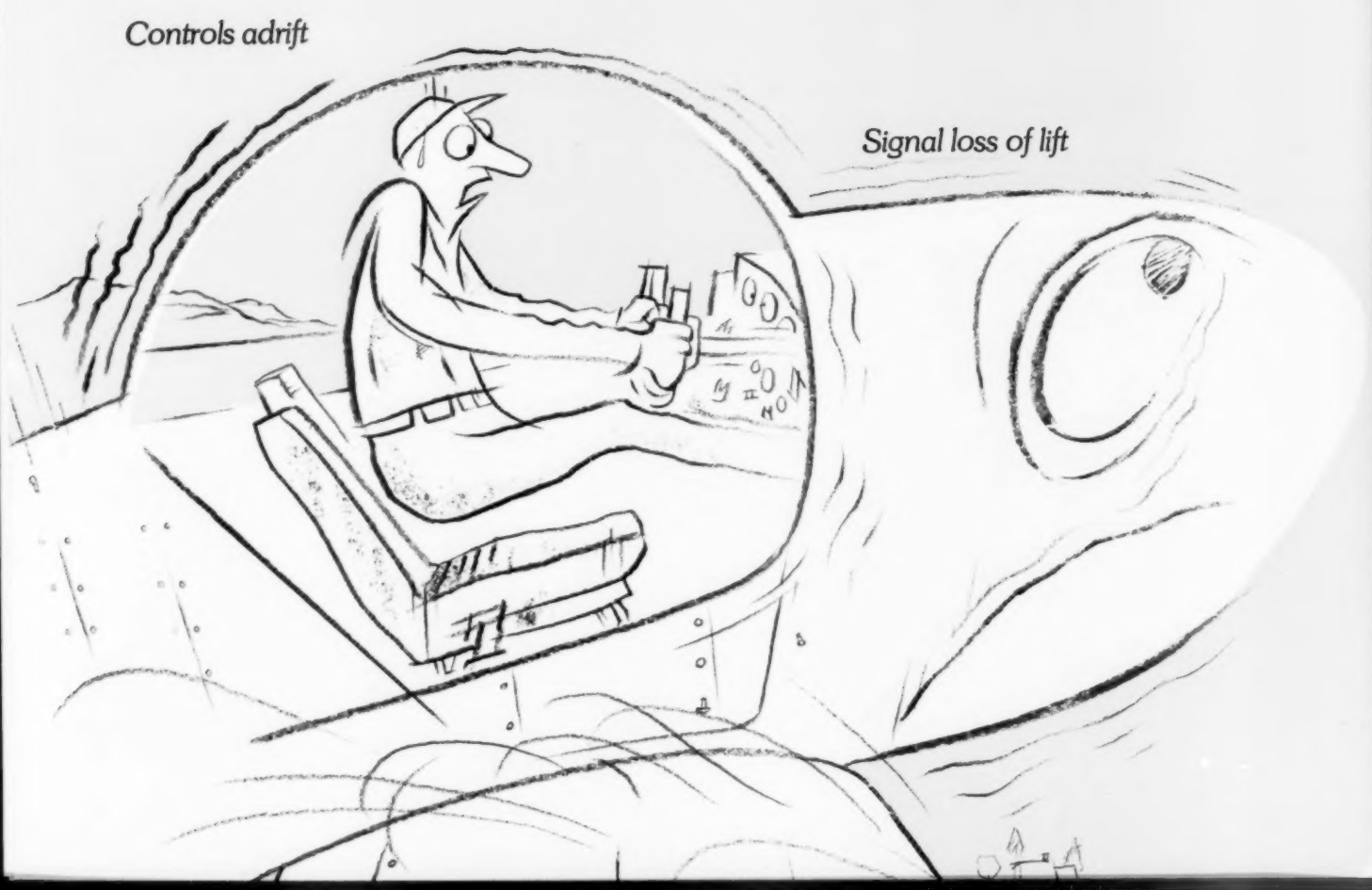
I know the procedure as charted but I would also like to know if the alternative that I have just mentioned is also open to the pilot.

Frank Ramirez
Santurce, PR

The pilot may not elect to use a holding pattern depicted as part of the missed approach in lieu of a procedure turn. However, in the absence of any instruction to the contrary, the pilot is permitted to use any type of course reversal for a procedure turn, which in some instances may approximate a charted missed approach holding pattern. Refer to AIM, Basic Flight Information, paragraph 371a.

U.S. GOVERNMENT PRINTING OFFICE
SUPERINTENDENT OF DOCUMENTS
WASHINGTON, D.C. 20402
OFFICIAL BUSINESS

Postage and Fees Paid
Federal Aviation Administration
Third class bulk
DOT 515

U.S. MAIL

FAN SERIA300SAISSDUE003R 1
SERIALS PROCESSING
UNIVERSITY MICROFILMS INTL
300 N ZEEB RD
ANN ARBOR MI 48106